

## **Development and Support for the USGODAE Server**

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### **LONG-TERM GOALS**

The USGODAE Monterey Data Server is envisioned as the hub for US (and international) GODAE projects. To meet this goal, the data server must fulfill three major roles. First, the server must act as a data server, providing reliable access to observational data and surface forcing fields to drive GODAE ocean models. Second, the server must be part of a framework to access and compare ocean model, or demonstration product output; so, researchers can validate and analyze their data. Finally, the server must have well-organized, easily accessible documentation to simplify data usage, and provide details for the many GODAE and US GODAE projects.

The USGODAE server should eventually become the first stop for users seeking US GODAE data, documentation, or model output. Through USGODAE, users will be able to locate data and documentation hosted both on and off the server. The Asia Pacific Data Research Center (ADPRC), which is hosted by the International Pacific Research Center (IPRC) at the University of Hawaii, will function as a companion data center in support of GODAE climate forecast. Over time the two servers will be configured to appear as a single virtual data service for GODAE users.

### **OBJECTIVES**

GODAE provides the context for bringing existing ocean data assimilation developments and applications together to accelerate improvements to models and transition to the operational environment. Ready access to quality-controlled observations is a necessity to achieve this. The GODAE server in Monterey is designed to satisfy this requirement, and at the same time to promote interactions between observationalists and data assimilators and between different assimilation groups. These interactions are needed to share and extend the knowledge base that will lead to a successful experiment.

The USGODAE Monterey server should be a prototype for data assembly centers (servers) in the Integrated Ocean Observing System (IOOS). To this end, the data server project must be closely involved with the projects developing, implementing, and promoting community data serving standards. This approach not only benefits the data server, by making data available through standard protocols and formats, but also helps promote the standards by serving data sets of interest to GODAE

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participants, and the broader oceanographic community. Furthermore, it aids the development of data serving software; since the standard servers must be adapted to the wide range of formats hosted on USGODAE, and made to work with the USGODAE near real-time data streams.

## **APPROACH**

The Monterey data server provides a stable, high reliability, high availability platform for data hosting. Since the servers are housed in the FNMOC operational data center, with 24x7 monitoring and support, users are guaranteed fast, dependable access to data and documentation. The server hosts a wide range of observational data, surface forcing fields, and model output, of interest to GODAE participants and the broader oceanographic community. Data discovery is simplified by an easy to use Web application that allows key-word searches, or direct selection from a data catalog. The discovery application provides users with complete access, usage, and documentation information for each data set.

One of the main challenges of hosting numerous data collections in several different formats is supplying users with the tools and documentation to retrieve and use the data effectively. The first step to solve this problem is providing complete documentation, and links to any available support programs through the data discovery application. Also, the server uses a number of Web applications, including Live Access Server (LAS), to generate quick on-line preview images of almost all of the data hosted on USGODAE. Finally, the server follows community data serving standards, like those specified in the National Virtual Ocean Data System (NVODS) and the Integrated Ocean Observing System Data Management and Communications (IOOS/DMAC) scheme. Consequently, users have a wide range of well-documented interfaces, APIs, and applications to access and use USGODAE data.

### **Key Individuals:**

**Program/Data Manager, Phil Sharfstein:** Provides oversight of the server, including assurance of correct and reliable operation of the server and its associated Web Site, documentation, evaluation of server functionality and utility, and coordination of work by supporting personnel at FNMOC and PMEL. Interacts with GODAE users to publicize and promote use of this data and respond to all requests for information from users. Performs outreach and interaction with the GODAE science community to identify and install new data sets on the server. Liaises with other data serving sites to ensure seamless presentation and minimize duplication. Promotes the server to the GODAE and general oceanographic communities.

**Systems Software/Hardware Support, FNMOC Staff:** Ensure 24x7 operations of the server, including proper operation of fail over and backup contingencies and data archival/retrieval functions and system security.

**Argo GDAC Manager, Mark Ignaszewski:** Installs and maintains the Argo Global Data Assembly Center (GDAC) software on the Monterey server. Monitors GDAC operations on the Monterey server and ensures GDAC data integrity are maintained on the server.

**GODAE Web Site Support, FNMOC Staff:** Maintains and supports the GODAE Server Web site.

**Visualization and Data Distribution Software Development and Support, Steve Hankin and staff members of the Thermal Modeling and Analysis Project (TMAP) at PMEL:** Provides software to enable uniform, interoperable browsing and comparison of complex curvilinear model outputs and data. Develops and tests initial prototypes of model inter-comparison framework to connect collaborating GODAE modelers. Provides liaison and coordination with the US Integrated Ocean Observing System as chair of the Data Management and Communications (DMAC) Steering Committee of IOOS. Provides liaison and coordination with the National Virtual Ocean Data System as a member of the NVO DS Executive Committee. Provides liaison and coordination with the APDRC GODAE climate data server in Hawaii.

## **WORK COMPLETED**

The Argo GDAC files have been upgraded to version 2.1 of the Argo NetCDF format. Profile, metadata, and trajectory files are synchronized between the US and French GDACS. There are now over 100,000 profiles on-line from eight regional Data Assembly Centers (DACs). The server also now hosts all of the Argo data that is not processed by any of the DACs under the DAC ID "GTS". Scientific quality controlled delayed-mode profiles are arriving at the GDACS. There are currently over 8,000 delayed-mode profiles on-line.

The data storage capacity has been increased to 2.4 Terabytes with the addition of 800 GB to the Sun disk array. Also, the associated Storage Area Network (SAN) has been reconfigured to remove the duplicated data volume, which increases SAN storage to 1.6 Terabytes, and eliminates synchronization delays between volumes.

FTP servers have been upgraded to the NcFTPd FTP server. This is the most secure, efficient FTP server available, providing enhanced control of system resources and network bandwidth. The server allows anonymous FTP session limits by IP address. This prevents a single user running a retrieval script from taking all available FTP connections.

Unicenter file transfer monitoring scripts have been developed to integrate file delivery monitoring with operational system monitoring. Missing or late file warnings are sent to the central Unicenter monitoring console. This provides 24x7 response for problems with the FNMOC operational file delivery. It can also be extended to monitor file delivery for all data sets on the server.

Several new data sets have been added to the server and integrated with the USGODAE data serving applications, including: Global Wave Watch 3, Global OTIS, FNMOC QC ship track data, FNMOC QC sea wave height, FNMOC QC GOES-12 SST, NAVO JASON SSH, NAVO GOES-12 SST, and University of Hawaii Sea Level Data in LAS

Data sets are now being pulled to the USGODAE Server from the FNMOC operational Metcast distribution servers. The data pull allows more flexibility in choosing data sets and fields. Currently WW3, OTIS, and several COAMPS model regions are retrieved to the server through Metcast.

Several GODAE pilot projects are now hosted on the USGODAE server. These include the Equatorial Intercomparison Experiment, where the server hosts information, links, and, eventually, data through LAS. The server also hosts the GODAE QC Intercomparison, including data, general project

information, and detailed QC procedure and file format information and links. We have developed decoders to convert data from all participants to a standard GODAE QC data format.

There are two new LAS Sister Servers with USGODAE: IPRC/USGODAE combines the near real-time holdings of USGODAE with the climate archive from APDRC/IPRC. The USGODAE sister with Japan Frontier Observational Research System for Global Change gives Japan Frontier LAS users direct access to USGODAE data through the Frontier LAS. Data sets on both sister servers are labeled and documented as coming from USGODAE

Individual profile selection tools have been added to LAS. These tools give users the ability to drill-down from a region/time selection to one or more individual profiles. This is currently implemented for the Argo data set.

## **IMPACT/APPLICATIONS**

The USGODAE server provides the framework for many projects essential to the success of GODAE, and the US efforts in GODAE. The server and LAS are positioned to be the focus point for several projects, including the US GODAE model intercomparison, GODAE Ocean QC intercomparison and MERSEA. As the central node in these projects, the data server project is in a unique position to develop methods for researchers to interact, and compare oceanographic data over the Internet.

As a prototypical IOOS data assembly center (data server), USGODAE will help shape the future of major data serving initiatives like NVODS and NOMADS (see below).

## **RELATED PROJECTS**

**National Virtual Ocean Data System (NVODS):** The USGODAE Server is part of NVODS and follows the community data serving standards specified by NVODS. Also, the USGODAE data server project contributes to the development and specification of NVODS standards. LAS provides uniform georeferenced visualization, subsetting and comparison for NVODS.

**NOAA Operational Model Archive and Distribution System (NOMADS):** The Monterey server serves as a prototype for public data servers in NOMADS. LAS is the principal visualization engine for NOMADS.

**Thematic Real Time Environmental Data Distribution System (THREDDS):** The data server project is active in the development of THREDDS data catalogs, and uses THREDDS catalogs as one method of data discovery on the servers.

**Cooperative Opportunity for NCEP Data Using IDD Technology (CONDUIT):** The USGODAE Server distributes data through UNIDATA's IDD system. The project is also involved with the planning and development of the CONDUIT system and software.

**International Pacific Research Center (IPRC) GODAE Climate Server:** Creating a blended real-time/climate GODAE site using LAS and OPeNDAP technology.

**Argo:** USGODAE is one of two Global Data Assembly Centers (GDACs), hosting the complete set of quality controlled Argo data.

**Tagging Of Pacific Pelagics (TOPP):** The project acts in an advisory role for TOPP, assisting by specifying data formats, quality control, and serving needs of the data assimilation community.

**NRL/HYCOM/ECCO/NSIPP (US GODAE R&D Systems):** The server provides data to force ocean models. Eventually, model output will be available through the USGODAE Model Intercomparison Project.

**GODAE High Resolution Sea Surface Temperature (GHRSSST):** The server provides data to GHRSSST to create ocean products. Eventually, the USGODAE server will host GHRSSST products, and may host a GHRSSST data assembly center.

**GODAE QC Project:** The USGODAE server will host the Quality Control (QC) project, providing data sets, comparison results, and documentation.

**GODAE Surface Forcing Intercomparison Project:** USGODAE provides surface forcing fields from FNMOC for the Surface Forcing Intercomparison Project.

## **PUBLICATIONS/OUTREACH**

Host: 2003 Argo Data Management Meeting.

"Status of the US GDAC", Presentation, 2003 Argo Data Management Meeting.

"Argo Data Serving on the US GDAC", Presentation, 2003 Argo Data Management Meeting.

"Status of the USGODAE Monterey Data Server", Presentation, 2004 USGODAE Steering Team Meeting.

Invited Participant: NSF Interoperable Data System Design Challenge Workshop.

Invited Participant: NVODS 2004 Annual Meeting.

Invited Participant: Argo 2004 Regional Center Meeting.

## **HONORS/AWARDS/PRIZES**

The USGODAE Server effort was recognized nationally this past year when the National Oceanographic Partnership Program (NOPP) presented the third annual *NOPP Award for Excellence in Partnering* to the Argo Project. The award was presented at the semi-annual meeting of the National Ocean Research Leadership Council (NORLC), the governing council of NOPP, held on February 11, in Washington, DC.